

NON-PUBLIC?: N

ACCESSION #: 9005100254

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Palo Verde Unit 3 PAGE: 1 OF 7

DOCKET NUMBER: 05000530

TITLE: Reactor Trip Due to Dropped Shutdown Group CEA

EVENT DATE: 04/14/90 LER #: 90-004-00 REPORT DATE: 05/07/90

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 081

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10

CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Thomas R. Bradish, Compliance Manager TELEPHONE: (602) 393-2521

COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: AA COMPONENT: OB MANUFACTURER: E146

REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On April 14, 1990, at approximately 0358 MST, Palo Verde Unit 3 was in Mode 1 (POWER OPERATION) at approximately 81 percent power when a reactor

trip occurred which resulted from a dropped shutdown group control element assembly (CEA). No other safety system responses occurred and none were required. The event was diagnosed as an uncomplicated reactor trip. At approximately 0413 MST on April 14, 1990, the plant was stabilized in Mode 3 (HOT STANDBY) at normal temperature and pressure.

The cause of the CEA dropping into the core was an optical isolator card malfunction. The malfunction was determined to be a random failure of a microchip on the card. As corrective action, the optical isolator card was replaced and successfully retested.

A similar event was reported in Unit 1 LER 528/85-088.

END OF ABSTRACT

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## I. DESCRIPTION OF WHAT OCCURRED:

### A. Initial Conditions:

At approximately 0358 MST on April 14, 1990, Palo Verde Unit 3 was in Mode 1 (POWER OPERATION) at reduced power (approximately 81 percent) for performance of monthly testing and scheduled preventive maintenance.

B. Reportable Event Description (Including Dates and Approximate Times of Major Occurrences):

Event Classification: Automatic actuation of the Reactor Protection System (RPS)(JC).

On April 14, 1990, at approximately 0358 MST a reactor (RCT)(AC) trip occurred which resulted from high Local Power Density (LPD) and low Departure from Nuclear Boiling Ratio (DNBR) trip signals due to a dropped shutdown group control element assembly (CEA) (AA)(ROD). No other safety system responses occurred and none were required. At approximately 0413 MST on April 14, 1990, the plant was stabilized in Mode 3 (HOT STANDBY) at normal temperature and pressure. The event was diagnosed as an uncomplicated reactor trip.

Prior to the event, on April 14, 1990 at approximately 0230 MST Palo Verde Unit 3 was in Mode 1 and reactor power was stabilized at approximately 81 percent power. Unit 3 was at reduced power in order to perform scheduled atmospheric dump valve (ADV) (SB)(V) testing, monthly CEA surveillance testing, and condensate pump (SD)(P) preventive maintenance.

At approximately 0336 MST, the reactor operators (RO) (utility, licensed) commenced performance of CEA exercise testing in accordance with an approved procedure. The first CEA group to be exercised was Shutdown Group 'A'. The group was inserted one step. At approximately 0357 MST, the RO performing the test observed that Shutdown Group 'A' CEA No. 80 had dropped into the core. The dropped CEA resulted in Core Protection

Calculator (CPC) (JC)(CPU) channel 'C' high LPD and low DNBR trip signals being generated. The RO informed the Control Room Supervisor (CRS) (utility, licensed) of the dropped rod and proceeded to enter the approved procedure for a dropped or slipped CEA. Approximately 42 seconds after the CEA dropped, CPC Channels 'A', 'B' and 'C' low DNBR trip signals were initiated, satisfying the

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two-out-of-four trip logic for the RPS and resulting in a reactor trip and subsequent main turbine generator (TA/TB)(TG) trip.

The CRS diagnosed the event as a reactor trip and entered the approved reactor trip procedure. At approximately 0413 MST, the plant was stabilized in Mode 3 (HOT STANDBY). No other safety system responses (including Engineered Safety Features Actuations (JE)) occurred and none were required. The Shift Supervisor (utility, licensed) declared the event an uncomplicated reactor trip.

C. Status of structures, systems, or components that were inoperable at the start of the event that contributed to the event:

Not applicable - no structures, systems, or components were inoperable at the start of the event which contributed to this event.

D. Cause of each component or system failure, if known:

Shutdown Group 'A' CEA No. 80 dropped into the core due to a malfunction of an optical isolator card. Investigation determined that a photodarlington optocoupler Type H11B1 on the optical isolator card failed. The failure was determined to be a random component failure.

E. Failure mode, mechanism, and effect of each failed component, if known:

The optical isolator card malfunction resulted in only two of three phases being supplied to the CEA upper gripper coil. Two phases are sufficient to hold the CEA in place; however, any attempts to move the CEA will result in slippage. When Shutdown Group 'A' was exercised for monthly testing, CEA No. 80 dropped into the core resulting in the reactor trip as described in Section I.B.

F. For failures of components with multiple functions, list of systems or secondary functions that were also affected:

Not applicable - no component failures were involved.

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G. For a failure that rendered a train of a safety system inoperable, estimated time elapsed from the discovery of the failure until the train was returned to service:

Not applicable - no failures were involved which rendered a train of a safety system inoperable.

H. Method of discovery of each component or system failure or procedural error:

The optical isolator card malfunction was discovered during troubleshooting performed after the event. There were no procedural errors which contributed to this event.

I. Cause of event

The cause of the reactor trip was high LPD and low DNBR trip signals resulting from a dropped shutdown group CEA. The cause of the CEA dropping into the core was an optical isolator card malfunction as described in Section I.B. The malfunction was determined to be a random component failure (SALP Cause Code E: Component Failure) as described in Section I.D.

No unusual characteristics of the work location (e.g., noise, heat, poor lighting) contributed to this event. There were no personnel errors which contributed to this event.

J. Safety System Response:

A reactor trip occurred which resulted from high LPD and low DNBR trip signals due to a dropped shutdown group control element assembly (CEA). At approximately 0357 MST, CPC Channel 'C' high LPD and low DNBR trip signals were received. Approximately 42 seconds later, CPC Channels 'A', 'B' and 'C'

low DNBR trip signals were initiated, satisfying the two-out-of-four trip logic for the RPS which resulted in a reactor trip and subsequent main turbine generator trip. There were no other safety system responses and none were necessary.

An investigation of the 42 second time lag was conducted and APS determined that the CPC response was proper, A detailed description is as follows:

Prior to the event, static CPC Channel 'C' DNBR was 2.15. When CEA No. 80 dropped, the CEA Computers (JC) (CPU)

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detected the CEA deviation and transmitted a CEA deviation penalty factor to all four CPC channels. CPC Channel 'C' initiated LPD and DNBR trip signals due to the CEA deviation, as designed. At this time, the remaining CPCs are estimated to have been calculating a static DNBR between 1.3 and 1.6. Due to the negative reactivity inserted as a result of the dropped CEA, RCS average temperature began dropping, and consequently, pressurizer

pressure started dropping. During the 42 seconds, pressurizer pressure dropped from 2252 psia to 2190 psia, a rate of approximately 1.5 psi per second. Additionally, the CEA Computers began generating Xenon penalty factors which were transmitted to the CPCs. The rate of decrease of pressurizer pressure, coupled with the increasing penalty factor, caused the updated value of DNBR to

continue to decrease. DNBR pretrips repeatedly annunciated and cleared as expected. After 42 seconds, the calculation of static DNBR approached the trip setpoint (1.24), and upon a subsequent execution of the CPC update program, Radial Peaking Factors (RPF) became excessive. The excessive RPFs resulted in a less than setpoint value for updated DNBR initiating the CPC Channel 'B' trip, immediately followed by the CPC Channel 'A' and 'D' trip. When this occurred, the two-out-of-four logic for the RPS was satisfied, resulting in a reactor trip and subsequent main turbine generator trip.

#### K. Failed Component Information:

The optical isolator card was manufactured by Electro-Mechanics Incorporated. The part number is E38322.

## II. ASSESSMENT OF THE SAFETY CONSEQUENCES AND IMPLICATIONS OF THIS EVENT:

A drop of a single full length CEA is an analyzed condition. When the circumstances of this event were compared to the analyzed event, it was determined that the analyzed event bounds the actual plant occurrence. Furthermore, the analysis demonstrated that all specified acceptable fuel design limits were met. The reactor trip occurred as it should have following the dropped CEA. No safety limits were violated and there are no nuclear safety issues as a result of this event. There were no safety consequences or implications resulting from this event.

### III. CORRECTIVE ACTION:

#### A. Immediate:

The optical isolator card for CEA No. 80 was replaced and CEA No. 80 was successfully retested after card replacement. No other card malfunctions were discovered.

#### B. Action to Prevent Recurrence:

APS Engineering performed a root cause of failure analysis. The results of the analysis are described in Section I.D. Additionally, Engineering contacted a manufacturer of the photodarlington optocouplers. Per discussions with the manufacturer, life expectancy cannot be accurately determined and there are no general application replacement recommendations. At PVNGS, there are 1068 H11B1 photodarlington optocouplers in each unit's CEA drive system, to date 8 failures have occurred. Based on the extremely low failure rate, no further actions to prevent recurrence are planned.

### IV. PREVIOUS SIMILAR EVENTS:

A previous similar event was reported in Unit 1 LER 85-088. As reported previously, a defective phase synchronizing card caused a loss of power to the part length CEA drive mechanism, which caused

the CEAs to drop, The phase synchronizing card was replaced and calibrated, and the associated CEA breaker was replaced as a precautionary measure. The problem was determined not to be of a generic nature, as this was the first failure observed during operation.

As discussed in Section I.I, the cause of the event reported in this LER (530/90-004) was a random component malfunction of an optical isolator card. Since different cards were involved, the previous corrective actions would not have prevented this event.

#### V. ADDITIONAL INFORMATION:

During the Emergency Notification System (ENS) notification, it was discussed that following the trip, Steam Generator No. 2 (AB)(SG) downcomer valve (V) did not operate properly since it had opened to approximately 95 percent and did not modulate to maintain SG level. APS performed an investigation of this concern during the post-trip evaluation and determined that, with the exception of a minor, initial

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SG No. 1 downcomer valve response anomaly, the SG downcomer valves responded properly during the event.

When the reactor trip occurred, a Reactor Trip Override (RTO) signal is generated in the Feedwater Control System (FWCS) (JB). The RTO closes the SG economizer valves (V), reduces the speed of the Main Feedwater Pump (SJ)(P), and modulates the downcomer valves to

maintain RCS average temperature (Tave) at the "no-load" setpoint. Immediately following a trip, Tave is above the no-load setpoint, therefore, the downcomer valves should respond by opening.

During the event described in this LER (530/90-004), the SG No. 1 downcomer valve initially went in the closed direction indicating that the RTO signal did not process properly in the FWCS. After approximately seven (7) seconds, SG No. 1 downcomer valve response was appropriate for the plant condition which existed at the time. SG No. 2 downcomer valve responded properly throughout the event. While stabilizing the plant following the trip, control room personnel (utility, licensed) took manual control of the SG downcomer valves in order to mitigate the RCS cooling since the response of the SG downcomer valves was different. The combination of the initial system improper response, control room personnel manual intervention, and the manner in which the system normally responds to plant events resulted in the disparity between downcomer valve positions.

Troubleshooting and testing could not identify the cause of the initial improper response of the SG No. 1 downcomer valve. During testing, the FWCS operated properly and the SG No. 1 downcomer valve operational anomaly could not be recreated. No component malfunctions were identified. An engineering evaluation determined that the momentary improper response could only have been caused by a sticking relay (RLY) on a Foxboro Module (Model No. 2AX<sub>09</sub>ECEP 8629) in the FWCS. The module was replaced and the system continued to operate properly. Further corrective actions are not planned.

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JAMES M. LEVINE 192-00658-JML/TRB/KR  
VICE PRESIDENT May 7, 1990  
NUCLEAR PRODUCTION

U. S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, DC 20555

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)  
Unit 3  
Docket No. STN 50-530 (License No. NPF-74)  
Licensee Event Report 90-004-00  
File: 90-020-404

Attached please find Licensee Event Report (LER) No. 90-004-00 prepared and submitted pursuant to 10CFR50.73. In accordance with 10CFR50.73(d), we are herewith forwarding a copy of this LER to the Regional Administrator of the Region V office.

If you have any questions, please contact T. R. Bradish, Compliance Manager at (602) 393-2521.

Very truly yours,

JML/TRB/KR/tlg

Attachment

cc: W. F. Conway (all with attachment)

J. B. Martin

D. H. Coe

T. L. Chan

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J. R. Newman

INPO Records Center

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